DOCUMENT RESUME

ED 300 633 CE 051 303

TITLE	Drafting 101, 201, 301. Industrial Arts.
INSTITUTION	Manitoba Dept. of Education, Winnipeg. Div. of Vocational Education.
REPORT NO	ISBN-0-7711-0648-3
PUB DATE	87
NOTE	241p.; For related documents, see CE 051 300-306.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	Behavioral Objectives; Career Exploration; Curriculum Guides; *Drafting; Foreign Countries; High Schools; *Industrial Arts; Learning Activities; Learning Modules; Safety

ABSTRACT

This curriculum guide outlines three credits of study, one credit for each of the grade levels 10, 11, and 12. Intended as an optional study area, the program provides awareness and exploration for those students who aspire to postsecondary study and introduces skills to those who wish to explore trades and technologies in employment after school. Each level has core and option modules that offer flexibility. Introductory materials include an overview, information on implementation, and goals and objectives. Drafting 101 has 11 modules: student orientation and safety, drafting review, drafting equipment and practices, geometric application, sketching, drawing interpretation, multiview drawing, dimensioning, pictorial drawing, developments and intersections, and career exploration. Drafting 201 has nine modules: student orientation and safety, review, product design, mechanical drawings, building construction drawings, electrical/electronic drawings, piping/fluidic drawings, technical illustration/sales drawings, and geological/topographical drawings. Drafting 301 has seven modules: student orientation and safety, review, computers and drafting, product manufacturing drafting, architectural drafting, engineering drafting, and other drafting applications. Each module has these components: major objective, student objectives, teachers' notes and suggested activities, and suggested materials. A six-page bibliography is provided, as well as a list of 23 publishers, with addresses. (YLB)

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Manitoba Education

1987

industrial arts

drafting 101, 201, 301

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This guide has been developed as part of the revision for Industrial Arts curricula for grades 7 through 12 in Manitoba schools and replaces the Industrial Arts 10-12 Drafting guide of 1962. It has been prepared in response to recommendations provided by the Industrial Arts 10-12 Steering Committee and subsequently approved by the Curriculum Policy Review Council.

The Drafting 101, 201, 301 Industrial Arts Senior High Curriculum Ad Hoc Committee provided the writer with the necessary technical and pedagogic support in reviewing the curriculum throughout its development.

DEDICATION

This guide is dedicated to the memory of Walter Szutiak of Miles Macdonell Collegiate who served on the Industrial Arts Drafting Curriculum Committee from June, 1984 to his untimely death on August 17, 1986.

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overview

INTRODUCTION

The Industrial Arts 10-12 Drafting curriculum guide outlines three credits of study, one credit for each of the grade levels 10, 11, and 12. Several general features have been integrated throughout the guides:

1. Industrial Arts provides learning opportunities for students with a wide range of abilities;

2. Career exploration and planning is incorporated into Industrial Arts programs;

3. Industrial Arts at the secondary level assumes that students have had no junior high school exposure to the program area; and

4. Basic and generic skills include problem solving, creative designing and decision making.

This program should be viewed as an optional study area for all secondary students. It provides awareness and exploration for those students who aspire to post-secondary study, as well as skills introductions to those students who wish to explore trades and technologies in employment after school. The avocational use of basic and generic skills serves the entire spectrum of students.

Schools are encouraged to make special efforts to include students in Industrial Arts programs who would normally perceive this area as traditionally suited to persons of the opposite sex. It is especially possible for the practical arts to play an important role in reversing sex-role stereotyping.

RATIONALE

Drafting 101, 201, 301 with its "hands-on" emphasis, has been designed to provide students with the opportunity to develop generic skills. Specifically, the Drafting program offers experience in the following areas:

- planning
- designing
- assessing and estimating materials/costs
- systematizing
- evaluating
- problem solving
- decision making.

Generally, Drafting 101, 201, 301 allows the student a flexible curriculum through which one can exercise time management, quality control, and teamwork.

This curriculum guide is a statement of INTENT, CONTENT, and DEPTH of study. It is prepared for the teacher as a guideline rather than a mandatory prescription. While teachers are invited to develop their course of study around this curriculum guide, it is ultimately left to them to assess and prepare their courses in accordance with their preferences for emphasis, the nature of facilities, their perception of student needs, school and administration philosophies, and community requirements. The use of CORE and OPTION modules is recommended to help the teacher accommodate the variables affecting the program.

STRUCTURE OF THE PROGRAM

Drafting 101, 201, 301 assumes that students who enter the program area for the first time will begin study at the 101 level. Each level has CORE modules which must be studied to the extent set by the teacher, and OPTION modules which offer the flexibility described in the Rationale for this course.

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implementation

IMPLEMENTATION

SAFETY

Industrial Arts courses, being practical and "hands-on" in nature, require that schools and teachers plan implementation strategies with care to safety concerns. Throughout this guide, special mention is made of safety concerns with regard to higher risk activities. However, SAFETY IS A CONCERN AT ALL TIMES, and it is the responsibility of those who deliver the courses to ensure that adequate and reasonable safety precautions have been taken.

TIME ALLOTMENT

Drafting 101, 201, and 301 are considered to be secondary school credits. Each credit is intended to be comprised of 110-120 hours of study. It is left to the schools to adjust their preferred emphases within the course objectives so unique needs may be met using this guide.

INTEGRATION OF TOPICS

Whereas this curriculum guide provides a suggested sequence of modules and topics within modules, it is recommended that the implementation of the course be based upon continued integration and revision of the following topics:

- safety
- career exploration
- consumerism
- applied mathematics
- communication skills.

Teachers are expected to integrate topics as suited to their unique preferences, emphases, laboratory requirements, student needs and sequencing of topics within the course.

In some instances it may be the choice of a teacher to provide a THEME around which the course will be implemented. The following themes are commonly integrated in Industrial Arts programs:

1. Process Orientation - a theme which emphasizes the systematic use of materials;

2. Product, or Project Orientation - a theme which focusses on the net result of skills developed;

3. Design Orientation - a theme which develops the creative problem-solving, and decision-making processes in a generic sense;

4. Tools and Materials Orientation - a theme which focusses on the equipment and supplies used in that particular area of Industrial Arts.

MATERIALS

Suggested text and supplemental materials, both for student use and teacher reference, are referred to throughout the guide. More detailed bibliographic data is provided in an appendix to this guide.

SPECIAL NEEDS STUDENTS

Industrial Arts 101, 201, 301 is designed as an option program for ALL STUDENTS found in the secondary school. Many pupils headed for the technical areas of colleges and universities benefit from secondary exposure to design, engineering, electronics, and the trades. Industrial Arts serves the special needs of the university student.

The special needs of the greatest number of secondary school students would include the exploratory and generic skills development emphasized in Industrial Arts. There is a strong linkage between the practical arts and life-long avocational skills necessary to everyday life.

Industrial Arts can provide some motivational value for students who enroll in these courses because they offer "alternative" credits to other less pragmatic options. The "hands-on" nature of Industrial Arts provides a multifaceted dimension to learning. The many senses involved in practical arts offer students a greater chance to experience success in their particular learning modes. While Industrial Arts is NOT DESIGNED TO BE AN AREA OF STUDY FOR THE LEARNING IMPAIRED, it CAN accommodate students in unique ways.

Many innovative programs for the physically handicapped have been developed, with safety precautions being taken into account. The use of jigs and fixtures for specific handicaps has offered new successes to such students. Tailoring Industrial Arts to the handicapped requires careful scrutiny of the hazards, safety requirements, methodologies, and special supports (fixtures, jig aids), as well as the recognition necessary from administrators and colleagues.

EVALUATION

Industrial Arts involves both theoretical and practical learning. Teachers are expected to conduct student evaluations in accordance with: their predetermined course planning (syllabus); the special theme or orientation used in the implementation; the specific objectives set for each student (special needs taken into account); and the standards of performance agreed upon at the outset. These are VALIDITY issues which will reflect the appropriateness of grades issued.

Generally, all teachers agree upon the range of criteria worthy of evaluation. Each teacher must, however, provide a unique WEIGHTING to validate his/her special blend of program variables implemented.

goals and objectives

GOALS AND OBJECTIVES

PROGRAM GOALS

The general goals of the senior high school Industrial Arts programs include the following:

1. to develop creative potential in both vocational and avocational life;
2. to gain an awareness of the role played by technology in the modern world;
3. to assist in the selection of a career choice and career plan;
4. to acquire basic and generic skills in the use of common industrial tools and machines, and in the implementation processes;
5. to develop a learning environment and attitude that fosters achievement in a practical manner;
6. to discover and develop talents, aptitudes and interests;
7. to develop problem solving skills;
8. to enhance one's understanding of self;
9. to develop teamwork attitudes and skills;
10. to develop an appreciation for decision making and problem solving techniques.

OBJECTIVES

The following listing includes all of the objectives cited in the Level II section of this guide. While the implementation of the objectives is required for both the CORE and OPTIONAL modules, it is left to individual teachers to assess whether certain objectives will be integrated generally or taught individually.

Emphasis and sequencing are also left to the teachers' judgment based on personal preferences, assessment of student needs and preferences, the nature of facilities and/or the particular theme around which the course is delivered (process, product, design, or tools orientation).

Drafting 101:

1. Student Orientation and Safety

The student should be able to:

- define drafting;
- outline the method of evaluation to be used in this course;
- organize a notebook;
- identify the basic laboratory equipment and features;
- explain the need for safe practices in the laboratory;
- differentiate between those behaviours which are considered safe and those which are not;
- describe the need for safe clothing in the laboratory;
- locate the safety aids in the laboratory;
- demonstrate the correct use of the safety aids found in the laboratory.

2. Junior High Drafting Review

The student should be able to:

- explain the purpose and importance of drafting;
- develop an understanding of the importance of planning;

- appreciate how drafting is used in industry;
- explain the importance and necessity of consistent measurement and standards;
- recognize types and functions of technical drawing scales;
- understand the International System (SI) basic units of measurement and the applications of SI metric and imperial units of measurement in drafting;
- recognize the fundamental elements of the design process;
- differentiate between orthographic drawing and pictorial drawing;
- describe how the use of sketches, orthographics and pictorials fits into the communication process in industry;
- recognize the importance and use of the tools in a basic drafting set.

3. Drafting Equipment and Practices

The student should be able to:

- identify the components of a straight edge/triangle system of drawing;
- identify the components of a drafting machine system of drawing;
- identify the components of a computer drawing system;
- use the straight edge/triangle system of drawing;
- use the drafting machine system of drawing;
- use the common accessory drafting devices;
- use metric, architectural, and engineering scales;
- identify the common types of drafting media;
- identify the standard sizes of drafting paper used in industry;
- use equipment associated with sketching, drawing, erasing, and keeping clean pencil and/or ink drawings;
- draw a standard set of line symbols (alphabet of lines) in pencil and/or ink drawings;
- identify the need for the common elements of a standard title block and border;
- recognize the need for each of the common styles of lettering used in drafting;
- demonstrate freehand lettering, using a common drafting style;
- identify common mechanical lettering systems used in drafting;
- recognize the advantages of using lettering, texture or symbol transfer sheets;
- fold each of the common sizes of drafting prints for storage, according to accepted practice;
- explain the various drawing reproduction processes.

4. Geometric Application

The student should be able to:

- define point, line, and plane;
- recognize basic geometric shapes;
- identify basic geometric solids;
- use a set of irregular curves;
- divide a line into any number of equal parts;
- construct a line perpendicular to a given line;
- draw a line parallel to a given line;
- copy a given angle;
- bisect a given angle;
- draw a basic geometric shape without templates;

- construct a circle by using any three points not in a straight line;
- draw a line tangent to a circle or an arc;
- construct an arc tangent to either two lines, two arcs, two circles, or a line and an arc.

5. Sketching

The student should be able to:

- recognize the purpose and applications of sketching in industry;
- identify appropriate sketching materials;
- develop proper pencil drawing techniques;
- use one common method of sketching vertical and horizontal lines;
- estimate and sketch inclined lines at each of the common angles used in drawing;
- sketch circles, arcs and other curved surfaces;
- sketch orthographic views, using straight, inclined and curved lines;
- sketch each of the three types of pictorial views, using straight, inclined and curved lines, with and without graph paper;
- enlarge and reduce a drawing, using a grid method;
- apply shading to any pictorial sketch.

6. Drawing Interpretation

The student should be able to:

- recognize main conventions related to product manufacturing drawings;
- apply drawing conventions to reading and interpreting product manufacturing drawings;
- recognize main conventions related to architectural drawings;
- apply drawing conventions to reading and interpreting civil/structural engineering drawings;
- recognize main conventions related to drawings of several other drafting applications;
- apply drawing conventions to reading and interpreting drawings of several other drafting applications.

7. Multiview Drawing

The student should be able to:

- recognize the need for multiview drawings in industry;
- differentiate between first angle and third angle projection;
- choose the appropriate front view to be used for an orthographic drawing of an object;
- choose the appropriate total number of views to be used for an orthographic drawing of an object;
- orient an orthographic drawing on a drawing sheet;
- draw third angle projections of objects involving plane surfaces, curved surfaces, intersections of plane and curved surfaces and hidden features;
- recognize the need for auxiliary views;
- differentiate between partial and full auxiliary views;
- recognize the three types of primary auxiliary views;
- draw partial auxiliary views of objects;
- identify secondary auxiliary views;
- recognize the need for sectional views and sections;

- identify the main types of sectional views;
- identify the main types of sections;
- draw several types of sectional views and sections;
- use appropriate section linings, cross-hatching, conventions and symbols.

8. Dimensioning

The student should be able to:

- identify the two components of dimensioning;
- recognize the main terms associated with size and location description;
- differentiate between overall and detailed dimensioning;
- identify the main dimensioning rules;
- dimension objects containing plane surfaces, angles, radii and circles;
- differentiate between unidirectional and aligned figure placement systems;
- use correct methods of indicating tolerances;
- identify the metric standards for dimensioning;
- explain both soft and hard conversions from imperial to metric units;
- dimension isometric and oblique drawings.

9. Pictorial Drawing

The student should be able to:

- recognize the value of pictorial drawings in industry;
- differentiate between projections and drawings;
- describe the features of the three types of pictorial drawings;
- identify the three types of oblique drawings;
- choose an appropriate front view, receding angle and receding plane orientation for an object to be drawn in oblique;
- draw oblique drawings of objects containing plane surfaces and curved surfaces;
- identify the three types of axonometric drawings;
- draw isometric drawings of objects containing plane surfaces and curved surfaces;
- use an isometric template;
- draw isometric half-sectioned drawings;
- draw isometric full-sectioned drawings;
- identify the three types of perspective drawings;
- identify the common points and lines associated with perspective drawing;
- draw one point perspective projections of objects containing plane surfaces;
- sketch two and/or three point perspective drawings of objects containing plane surfaces;
- recognize several types of perspective drafting devices;
- draw "exploded" illustrations, using any of the three types of pictorial drawing methods.

10. Developments and Intersections

The student should be able to:

- explain the uses of developments;
- recognize the common symbols and lines associated with developments;
- draw parallel line developments of objects containing plane and curved surfaces;
- create a parallel line development of two simple intersecting shapes;

- construct radial line developments of whole and truncated cones and pyramids;
- draw a pattern for a simple object, using triangulation;
- construct a development for a transition piece between two simple shapes, using triangulation.

11. Career Exploration

The student should be able to:

- identify careers related to drafting;
- collect information about careers related to drafting;
- identify skills required for jobs related to drafting;
- identify personal interests, abilities and needs;
- recognize the relevance of attitudes to working conditions and success;
- identify realistic educational and training plans for drafting occupations;
- recognize the impact of technology on drafting careers;
- explain the influence of social and economic trends on drafting careers;
- identify ways in which jobs are advertised;
- understand the objectives of a job description;
- explain the need for a resumé, a portfolio, an application and an interview.

Drafting 201:

1. Student Orientation and Safety

The student should be able to:

- define drafting;
- outline the method of evaluation to be used in this course;
- organize a notebook;
- identify the basic laboratory equipment and features;
- explain the need for safe practices in the laboratory;
- differentiate between those behaviours which are considered safe and those which are not;
- describe the need for safe clothing in the laboratory;
- locate the safety aids in the laboratory,
- demonstrate the correct use of the safety aids found in the laboratory.

2. Drafting Review

Refer to Drafting 101.

3. Product Design

The student should be able to:

- identify the elements of design;
- explain the purpose of the elements of design;
- use the elements of design;
- identify the principles of design;
- explain the purpose of the principles of design;
- use the principles of design;
- identify the stages of the design process;
- explain the purpose of each of the stages of the design process;
- use the stages of the design process.

4. Mechanical Drawings

The student should be able to:

- define working (or production) drawing;
- describe the two classifications of working drawings;
- define tolerances;
- explain the purposes of tolerances on drawings;
- list the ways of expressing tolerances on drawings;
- use accepted conventions of applying tolerances to drawings;
- explain the reasons for surface texture control;
- apply surface finishing specifications to a drawing, using accepted conventions;
- define numeric control;
- describe the two-dimensional system of numeric control;
- list the positive and negative characteristics of several types of materials used in manufacturing;
- describe several primary production processes used in manufacturing materials;
- explain several secondary production processes used in manufacturing materials;
- list several types of threaded fasteners;
- differentiate between pictorial and conventional (simplified) representations of threads;
- draw each of the two types of representations of threads, given the specifications for the fastener;
- draw the welding schematic symbols for several common welding joints;
- use welding schematic symbols in simple mechanical drawings;
- sketch several common types of gears;
- identify the common terms used in describing simple spur gears;
- draw a simple spur gear, given its specifications;
- identify the common terms associated with cams;
- draw a cam given the displacement diagrams of the follower.

5. Building Construction Drawings

The student should be able to:

- differentiate between presentation drawings and construction drawings;
- construct an interior one point perspective projection, given a simple floor plan;
- identify the common basic house types;
- recognize the common roof types;
- draw the four elevations of a building;
- construct a two point perspective projection of a building;
- identify the symbols used to represent common floor plan components;
- draw a plan view of a simple building;
- explain the basic terms used in house construction;
- draw a section of a house wall and foundation;
- compile the window, door, cabinet and finish schedule sheets for a simple house design.

6. Electrical/Electronic Drawings

The student should be able to:

- differentiate between the four types of electrical diagrams as defined by the Canadian Standards Association;
- recognize the common symbols and connections associated with single line diagrams;
- draw a single line diagram of a simple electrical/electronic system;

- identify the common symbols associated with electronic schematic diagrams;
- draw a schematic diagram of an electronic circuit;
- explain the five types of connection/interconnection wiring diagrams;
- draw a symbol connection diagram of an electrical system using one of the five types;
- produce a pictorial connection diagram of an electrical system using one of the five types;
- draw the electrical connection plan of a simple house;
- draw an interconnection diagram of an electrical system using any one of the five types;
- design a printed circuit layout for a simple electronic circuit.

7. Piping/Fluidic

The student should be able to:

- identify the four types of piping drawings commonly used;
- recognize several of the common graphic symbols used in single-line piping drawings;
- draw orthographic or isometric single-line drawings of a simple piping system;
- draw orthographic or isometric double-line drawings of a simple piping system;
- differentiate between the four types of fluid circuit diagrams;
- identify several of the common symbols used in graphical fluid circuit diagrams;
- draw a graphical diagram of a simple fluid system;
- produce a pictorial diagram of a simple fluid system;
- draw a cutaway diagram of a simple fluid system;
- prepare a combination diagram of a simple fluid system.

8. Technical Illustration/Sales Drawings

The student should be able to:

- define technical illustration;
- list and give examples of several uses of technical illustrations;
- identify the specialized equipment used by technical illustrators;
- differentiate between outline shading and surface shading;
- apply outline shading to a pictorial drawing;
- illustrate several types of surface shading;
- apply surface shading to a pictorial drawing;
- draw an exploded orthographic drawing of an assembly;
- construct an exploded pictorial drawing of an assembly;
- list the materials required for airbrushing;
- explain the operation of the two types of airbrushes;
- airbrush a pictorial illustration,
- list the materials required for producing wash renderings;
- identify the techniques for applying colour washes;
- apply watercolour wash rendering to a pictorial drawing;
- identify various media used to create renderings;
- use several other types of rendering media;
- list several types of graphs and charts used in technical illustration;
- choose an appropriate type of graph or chart to illustrate a set of data;

. draw a graph or chart to illustrate a set of data.

9. Geological/Topographical Drawings

The student should be able to:

. identify the typical scales used in map drawings;
. describe several types of maps used in industry;
. prepare a cadastral map of a simple subdivision;
. draw a plot survey plan of a portion of a development;
. construct a building site plan;
. prepare a contour topographical map from a set of survey elevations;
. convert a simple topographical map into a block diagram (three dimensional isometric contour drawing);
. draw a simple geological surface map;
. draw a geological section of a simple geological surface map;
. produce a cartographic map.

Drafting 301:

1. Student Orientation and Safety

The student should be able to:

. define drafting;
. outline the method of evaluation to be used in this course;
. organize a notebook;
. identify the basic laboratory equipment and features;
. explain the need for safe practices in the laboratory;
. differentiate between those behaviours which are considered safe and those which are not;
. describe the need for safe clothing in the laboratory;
. locate the safety aids in the laboratory;
. demonstrate the correct use of the safety aids found in the laboratory.

2. Drafting Review

Refer to Drafting 201.

3. Computers and Drafting

The student should be able to:

. define CAD;
. explain the main categories of equipment associated with CAD;
. describe several types of CAD input devices;
. list the applications of several types of CAD input devices;
. describe several processing and storage devices used in CAD systems;
. list the function of each processing/storage device used in CAD systems;
. describe several output devices used in CAD systems;
. list the advantages of each type of output device used in CAD systems;
. describe the three basic command categories used in CAD systems;
. describe the effects of CAD systems on drafting.

4. Product Manufacturing Drafting

The student should be able to:

- explain each level of the graphic communication process;
- create several designs for a simple device with a prescribed set of specifications, using accepted design techniques at the creative communication level;
- sketch a set of drawings to fully explain a design at the technical communication level;
- explain each of the four basic types of model studies used in industry;
- prepare an appropriate model study of a simple design;
- create a presentation drawing of a simple design;
- define detail working drawing;
- describe the types of detail working drawings;
- define assembly working drawing;
- describe the types of assembly working drawings;
- prepare a set of detail working drawings of a simple design;
- prepare a set of assembly working drawings of a simple design.

5. Architectural Drafting

The student should be able to:

- list the requirements of a good architectural lettering style;
- develop a style of architectural lettering;
- identify several common styles of architecture;
- list some factors affecting the placement of a house on a lot;

- detail the factors affecting the use of interior space in a house design;
- identify the factors to be considered in developing an energy efficient house design;
- design a simple house, following a set of specifications;
- prepare a presentation drawing set for a simple house design sketch;
- construct an architectural model of a simple house design;
- outline a typical sequence/organization of a set of architectural working drawings;
- prepare a site plan for a simple house design;
- draw a foundation plan for a simple house design;
- draft a set of floor plans for a simple house design;
- prepare a set of elevations for a simple house design;
- draw a building section for a simple house design;
- draft a set of interior details for a simple house design;
- compile a set of schedules for a simple house design;

6. Engineering Drafting

The student should be able to:

- list factors affecting a community plan;
- outline the fundamental services to be incorporated into a community plan;
- design a simple sub-division, following a set of specifications;
- survey a plot of land to determine a grid of elevations;

- prepare a topographical model of a set of elevations;
- detail the typical types of engineering drawings required for commercial projects;
- sketch several steel beam cross section shapes;
- illustrate several steel structure systems.

7. Other Drafting Applications

The student should be able to:

- identify the terms and symbols associated with sheet metal design;
- design the patterns for the components of a simple sheet metal assembly;
- describe how drawings are used in the aerospace industry;
- construct a simple aerospace orthographic drawing;
- identify how drawings are used in the automotive industry;
- produce a simple drawing typical of those produced in the automotive industry;
- describe how drawings are used in the marine industry;
- create a simple marine drawing;
- differentiate between jigs and fixtures;
- design a simple assembly (or machining) jig or fixture to do a specified task.

drafting 101

DRAFTING 101

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STUDENT ORIENTATION AND SAFETY DR101-01

Major Objective: To gain information about the drafting course, and about how to function successfully and safely in the program.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define drafting.	Have the students prepare a researched definition of the term drafting.	Drafting A universal graphic language of industry, used for communicating technical ideas.
2. Outline the method of evaluation to be used in this course.	Explain the system of evaluation to be used in the course, including a breakdown of grades to be allotted for projects, quizzes, exams, attendance, notebooks, etc., and the method of marking to be used on projects.	
3. Organize a notebook.	Have the students set up and maintain an orderly notebook that includes sections for notes, definitions, quizzes, projects, and other supplementary materials.	
4. Identify the basic laboratory equipment and features.	Indicate the location of laboratory features and equipment necessary for proper and safe student functioning in the laboratory.	Lab Orientation Information 1. Fire Exits, Extinguishers and Alarm Switches 2. Major Pieces of Equipment 3. Tool Storage 4. Project Storage

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Explain the need for safe practices in the laboratory.	Organize safety seminars and use routine situations in daily laboratory practice to demonstrate the proper procedures and techniques for safe handling of drafting equipment and tools.	
6. Differentiate between those behaviours which are considered safe and those which are not.	Have students describe alternative procedures for performing tasks in the laboratory, and explain the safety considerations of each alternative.	
7. Describe the need for safe clothing in the laboratory.	Have students participate in establishing an acceptable dress code for the program.	
8. Locate the safety aids in the laboratory.	Discuss the proper location and use of any safety aids found in the laboratory or in close proximity to the laboratory. Have students demonstrate how they would handle incidents of injury, fire, and other emergencies.	
9. Demonstrate the correct use of the safety aids found in the laboratory.		

JUNIOR HIGH DRAFTING REVIEW DR101-02 (Option)

Major Objective: To review those aspects of the junior high drafting program which are important as an introduction to senior high drafting.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Explain the purpose and importance of drafting.	Using slides, films or photographs demonstrate how drafting is related to industry. Have the students prepare a bulletin board display of drawings, maps and charts illustrating the role and types of drafting in industry. Show students how drafting provides a pictorial language to explain procedures or components of designs.	Types of Drafting Used in Industry 1. Product Manufacturing Drafting 2. Architectural Drafting 3. Engineering Drafting 4. Sheet Metal Drafting 5. Aerospace Drafting 6. Automotive Drafting 7. Marine Drafting 8. Jig/Fixture Drafting Graphic Communications, Grade 7-9, Manitoba Education, 1983
2. Develop an understanding of the importance of planning.	Explain the relationship between planning and drafting. Make the students aware of the importance and relationship of long term and short term planning for projects and related activities.	
3. Appreciate how drafting is used in industry.	Provide examples of how drafting is used in preparing plans, working drawings and pictorial drawings.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Explain the importance and necessity of consistent measurement and standards.	Explain the necessity of consistent measurement and standards for drafting to be a truly "universal" language of industry.	
5. Recognize the types and functions of technical drawing scales.	Familiarize students with the types of scales used in technical drawings by pointing out differences and similarities in shapes, sizes and units of measurement.	Types of Scales Used in Technical Drawings 1. Metric Reducing Scales 2. Metric Enlarging Scales 3. Non-Metric Reducing Scales 4. Non-Metric Enlarging Scales
6. Understand the International System (SI) basic units of measurement and the applications of SI metric and imperial units of measurement in drafting.	Have the students do exercises with each type of scale. NOTE: Emphasis should be on SI metric, however, there are special circumstances under which imperial measurements would be called for.	Basic Units of Measurement 1. Length 2. Time 3. Mass 4. Temperature 5. Electric Current 6. Luminous Intensity

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
7. Recognize the fundamental elements of the design process.	Describe the design process from definition of problem to implementation of design. Have the students follow the design process in a simple design problem.	Design Process 1. Problem 2. Restrictions 3. Requirements 4. Resources 5. Evaluation 6. Alternatives 7. Testing/Selection 8. Revision/Refining 9. Implementation
8. Differentiate between orthographic drawing and pictorial drawing.	Have the students sketch a simple object, using both orthographic and pictorial drawing methods.	Orthographic Drawing A representation by drawing a number of separate views of an object as seen from different positions, and by arranging the views in a systematic manner, projected one from another. Pictorial Drawing A single view picture drawing.
9. Describe how the use of sketches, orthographics and pictorials fits into the communication process in industry.	Demonstrate how ideas are readily presented through the use of views and pictorials, emphasizing that "a picture is worth a thousand words." Use examples such as a car or house to illustrate how a design can be developed and modified with the use of pictorial and orthographic sketches. Show how that same design is then implemented with the use of pictorial and orthographic drawings.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
10. Recognize the importance and use of the tools in a basic drafting set.	Devising a simple layout of a basic drafting set as a focus for instruction, demonstrate the proper use and care of each instrument.	Basic Drafting Set 1. Drawing Board 2. T-Square or Parallel Rule 3. Set Squares 4. Pencils 5. Eraser 6. Erasing Shield 7. Scales 8. Brush

DRAFTING EQUIPMENT AND PRACTICES DR101-03

Major Objective: To obtain knowledge about drafting tools, systems and materials and to develop skills in their use.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the components of a straight edge/triangle system of drawing.	Demonstrate the use of a straight edge/triangle system in making a simple layout. Point out the proper use and care of the components of the system.	Components of a Straight Edge/Triangle System 1. T-Square or Parallel Rule 2. Drafting Triangle Set 3. Scales (Usually Triangular) 4. Drawing Surface
2. Identify the components of a drafting drawing machine system.	Demonstrate a simple layout by utilizing a drafting machine system. Point out the proper use and scale of the components of the system. Indicate the advantages of this system over the straight edge/triangle system.	Components of a Drafting Machine System 1. Arm Type or Track Type Drafting Machine 2. Scales (Flat) 3. Drawing Surface
3. Identify the components of a computer drawing system.	Demonstrate the formulation of a simple computerized layout. If the system is unavailable, illustrate its use through slides, film, photographs, or other means.	Components of a Computer Drawing System 1. Input Device 2. Processor 3. Storage System 4. Output Device

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Use the straight edge/ triangle system of drawing.	Assign projects requiring students to use the straight/edge triangle drafting system.	
5. Use the drafting machine system of drawing.	Have the students use the drafting machine system when completing the projects assigned for this course.	
6. Use the common accessory drafting devices.	Have students utilize the common accessory drafting devices while doing projects assigned for the course.	Accessory Drafting Devices 1. Templates 2. Compasses 3. Flex Curves 4. Irregular Curves 5. Protractors 6. Dividers
7. Use metric, architectural, and engineering scales.	NOTE: Emphasis should be on SI metric scales. Have the students draw a simple object using each of the three scales (metric, architectural and engineering).	
8. Identify the common types of drafting media.	Discuss the history of and demonstrate the current applications of each of the common types of drafting media. Have the students use the different types and sizes of drafting paper when doing the projects assigned for the course.	Common Types of Drafting Media 1. Paper 2. Vellum 3. Tracing Cloth 4. Polyester Film

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Identify the standard sizes of drafting paper used in industry.	Have the class design and display a series of posters illustrating the standard metric and imperial paper sizes.	Standard Drafting Paper Sizes Metric (Millimetre) A0 = 841 x 1189 A1 = 594 x 841 A2 = 420 x 594 A3 = 297 x 420 A4 = 210 x 297 Imperial (Inch) A = 8.50 x 11.00 B = 11.00 x 17.00 C = 17.00 x 22.00 D = 22.00 x 34.00 E = 34.00 x 44.00
10. Use equipment associated with sketching, drawing, erasing, and keeping clean pencil and/or ink drawings.	Have the students use this equipment as part of the process of doing the projects assigned for this course.	Associated Equipment Used in Drawing, Erasing and Cleaning 1. Drafting Pencils 2. Lead Pointers 3. Erasers 4. Erasing Machines 5. Cleaners 6. Erasing Shields 7. Brushes 8. Inking Pens

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
11. Draw a standard set of line symbols (alphabet of lines) in pencil and/or ink.	Have the students prepare a set of line symbols (alphabet of lines) for inclusion in their notebooks.	Alphabet of Lines 1. Visible Lines 2. Hidden Lines 3. Center Lines 4. Extension & Dimension Lines 5. Leaders 6. Break Lines 7. Cutting Planes Lines 8. Section Lines 9. Viewing Plane Lines 10. Phantom Lines
12. Identify the need for the common elements of a standard title block and border.	Have the students research a list of the items in a title block commonly used in industry.	Elements of a Title Block 1. Drawing Number 2. Name of Firm or Organization 3. Title or Description 4. Scale 5. Dates 6. Signatures 7. Approvals 8. Job, Order or Contract Number 9. References
13. Recognize the need for each of the common styles of lettering used in drafting.	Demonstrate and illustrate the need for each of the common styles of drafting lettering.	Common Styles of Lettering Used in Drafting 1. Single Stroke Gothic 2. Micro Font 3. Architectural

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
14. Demonstrate freehand lettering, using a common drafting style.	Have the students use freehand lettering on projects assigned for the course.	
15. Identify common mechanical lettering systems used in drafting.	Have the students use mechanical lettering systems on projects assigned for the course. If the systems are unavailable, illustrate their use through slides, films or photographs.	Mechanical Lettering Systems 1. Templates 2. Scribe and Template Systems 3. Lettering Typewriter
16. Recognize the advantages of using lettering, texture or symbol transfer sheets.	Integrate the use of transfer sheets with the projects assigned for the course.	Advantages of Transfer Sheets 1. Time Saving 2. Accurate 3. Easy to Use
17. Fold each of the common sizes of drafting prints for storage, according to accepted practice.		
18. Explain the various drawing reproduction processes.	Acquaint the students with drawing reproduction processes, using practical demonstrations, slides, films or photographs to support the discussion. Wherever possible, have the students use the drawing reproduction processes.	Drawing Reproduction Processes 1. Blueprint 2. Diazo 3. Electrostatic (Xerographic) 4. Photographic - Silver Process (Microfilm, Photo Contact, Photocopy, Lithoprint) 5. Thermographic

GEOMETRIC APPLICATION DR101-04

Major Objective: To acquire the basic geometric construction skills used in drafting.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define point, line, and plane.	Point out that the graphical solutions of three dimensional forms require an understanding of the space relations which points, lines and planes share in forming any given shape.	Point An element that has a location but no dimensions. Line An element that has no width, only length. Plane A surface of such nature that a straight line connecting any two of its points lies wholly on that surface.
2. Recognize basic geometric shapes.	Have the students sketch the basic geometric shapes in their notebooks.	Basic Geometric Shapes 1. Square 2. Rectangle 3. Rhombus, Rhomboid 4. Trapezoid, Trapezium 5. Pentagon 6. Hexagon 7. Heptagon 8. Octagon 9. Circle 10. Ellipse

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
3. Identify basic geometric solids.	Have the students sketch the basic geometric solids in their notebooks.	Basic Geometric Solids 1. Cube 2. Right Rectangle 3. Right Triangular Prism 4. Right Triangular Pyramid 5. Right Cylinder 6. Right Cone 7. Sphere
4. Use a set of irregular curves.	Have the students use a set of irregular curves to produce a drawing or graph that involves curved lines.	Types of Irregular Curve Sets 1. French Curves 2. Railway Curves 3. Mechanical Engineer's Curves 4. Copenhagen Ship Curves
5. Divide a line into any number of equal parts.	NOTE: Integrate geometric constructions with the projects assigned for this course.	
6. Construct a line perpendicular to a given line.		
7. Draw a line parallel to a given line.		
8. Copy a given angle.		

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Bisect a given angle.		
10. Draw a basic geometric shape without templates.		
11. Construct a circle by using any three points not in a straight line.		
12. Draw a line tangent to a circle or an arc.		
13. Construct an arc tangent to either two lines, two arcs, two circles, or a line and an arc.		

SKETCHING DR101-05

Major Objective: To recognize the significance of, to gain knowledge about, and to explore skills, techniques and applications pertinent to freehand sketching for drafting.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Recognize the purpose and applications of sketching in industry.	Demonstrate how the solution to a given problem in industry can be quickly and efficiently communicated through the use of sketching.	
2. Identify appropriate sketching materials.	Demonstrate the proper use of the materials used in sketching.	Sketching Materials 1. Pencil 2. Eraser 3. Bluegrid Paper 4. Graph Paper 5. Isometric Sketch Paper
3. Develop proper pencil drawing techniques.	Have the students experiment by sketching lines with a pencil, controlling the type of line (object, construction, etc.) with the sharpness of the pencil point and the denseness by the pressure applied.	
4. Use one common method of sketching vertical and horizontal lines.	Have the students sketch several lines using each of the common methods.	Common Line Sketching Methods 1. Continuously Sketched 2. A Line Guided by a Short Dash at the Beginning and End 3. A Series of Separated Strokes 4. A Series of Overlapping Strokes

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Estimate and sketch inclined lines at each of the common angles used in drawing.	Have the students practice estimating and sketching several lines at each of the common angles used in drafting.	Common Angles Used in Drafting 1. 30 Degrees 2. 45 Degrees 3. 60 Degrees
6. Sketch circles, arcs and other curved surfaces.	Emphasize the use of correct techniques. Have students experiment with various methods of sketching circles, arcs and other curved surfaces.	
7. Sketch orthographic views, using straight, inclined and curved lines.	Have the students sketch the six orthographic views of models of objects.	Six Orthographic Views 1. Front 2. Top 3. Right Side 4. Left Side 5. Bottom 6. Rear
8. Sketch each of the three types of pictorial views, using straight, inclined and curved lines, with and without graph paper.	Have the students sketch objects progressing from simple to more detailed shapes, using inclined surfaces, circles, arcs and curved surfaces.	Three Pictorial Views 1. Oblique 2. Axonometric 3. Perspective
9. Enlarge and reduce a drawing, using a grid method.	Have the students reduce or enlarge a simple design by sketching the design square by square, on a reduced or enlarged proportional grid.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
10. Apply shading to any pictorial sketch.	Have the students apply shading to pictorial sketches using any type of surface shading.	Types of Surface Shading 1. Freehand Line 2. Ruled Line 3. Stippled 4. Smudge

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DRAWING INTERPRETATION DR101-06

Major Objective: To recognize, gain an understanding of and interpret drawings representative of a cross section of drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Recognize main conventions related to product manufacturing drawings.	Have the students answer questions related to a given set of product manufacturing drawings.	Product Manufacturing Drawings Drawings, usually mechanical in nature, having to do with the design and manufacture of products.
2. Apply drawing conventions to reading and interpreting product manufacturing drawings.		
3. Recognize main conventions related to architectural drawings.	Have the students answer questions related to a given set of architectural drawings.	Architectural Drawings Drawings having to do with the design and construction of structures.
4. Apply drawing conventions to reading and interpreting architectural drawings.		

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Recognize main conventions related to civil/structural engineering drawings.	Have the students answer questions related to a given set of civil/structural engineering drawings.	Civil/Structural Engineering Drawings Drawings having to do with areas of engineering such as the incorporation of services into a community plan, topographical mapping, and/or structural construction.
6. Apply drawing conventions to reading and interpreting civil/structural engineering drawings.		
7. Recognize main conventions related to drawings of several other drafting applications.	Have the students answer questions related to a given set of drawings representing several other drafting applications.	Other Drafting Applications 1. Sheet Metal Drawings 2. Aerospace Drawings 3. Automotive Drawings 4. Marine Industry Drawings 5. Jig/Fixture Design Drawings
8. Apply drawing conventions to reading and interpreting drawings of several other drafting applications.		

MULTIVIEW DRAWING DR101-07

Major Objective: To explore the purpose of, to gain an understanding of and to develop skills in multiview drawing, including orthographic, auxiliary and sectional views.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Recognize the need for multiview drawings in industry.	Emphasize that drawings are a communicative mode by demonstrating how multiview drawings represent an object on flat paper in such a way that it can be quickly and accurately understood by people of varied backgrounds and cultures.	
2. Differentiate between first angle and third angle projection.	Demonstrate both types of orthographic projection.	First Angle Projection A type of projection, used in many European and Asiatic countries, in which all views are projected onto planes located behind the object. Third Angle Projection A type of projection, used in Canada, the United States and many other countries, in which the views are projected onto planes lying between the object and the viewer.
3. Choose the appropriate front view to be used for an orthographic drawing of an object.	Have the students choose the appropriate front view of given objects.	Appropriate Front View Usually a view of an object that shows the shape most clearly, and includes the longest dimension and the least number of hidden lines.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Choose the appropriate total number of views to be used for an orthographic drawing of an object.	Have the students choose the appropriate number of views required for given objects.	Appropriate Number of Views 1. Two views for cylindrical and symetrical objects 2. Three views for most other objects
5. Orient an orthographic drawing on a drawing sheet.	Have the students orient and draw several orthographic drawings paying attention to: number of views, placement of views and spacing of views.	
6. Draw third angle projections of objects involving plane surfaces, curved surfaces, intersections of plane and curved surfaces and hidden features.	Have the students draw the orthographic projections of several objects ranging from simple objects with plane surfaces, to complex objects with curved surfaces.	
7. Recognize the need for auxiliary views.	Display several objects that would best be drawn using a partial or full auxiliary view in place of a conventional view.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
8. Differentiate between partial and full auxiliary views.	Demonstrate the difference between the two types of auxiliary views, indicating that the partial auxiliary view is used most often because it shows only surfaces which are true size and not distorted.	Partial Auxiliary View A partial auxiliary view shows only the inclined surface of an object. Full Auxiliary View A full auxiliary view shows all surfaces and lines of an object including the inclined surfaces.
9. Recognize the three types of primary auxiliary views.	Have the students sketch the auxiliary views of several objects, using the three types of primary auxiliary views.	Types of Primary Auxiliary Views 1. Elevation (or Top) 2. Right and Left 3. Front and Rear
10. Draw partial auxiliary views of objects.	Have the students draw the partial auxiliary view of a simple object.	
11. Identify secondary auxiliary views.	Indicate the need for a secondary auxiliary view in some special cases. Have students sketch objects requiring secondary auxiliary views.	Secondary Auxiliary View An auxiliary view that is projected off a primary auxiliary view.
12. Recognize the need for sectional views and sections.	Demonstrate several objects that would best be represented with the use of a sectional view or section.	Sectional View A view made by passing an imaginary cutting plane through an object, removing one part and leaving the interior details exposed.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
13. Identify the main types of sectional views.	Demonstrate the method of drawing the main types of sectional views.	Types of Sectional Views 1. Full 2. Half 3. Offset 4. Broken Out
14. Identify the main types of sections.	Use drawing examples of the main types of sections.	Types of Sections 1. Aligned 2. Auxiliary 3. Revolved 4. Removed
15. Draw several types of sectional views and sections.	Have the students produce multiview drawings of several objects, using various types of sectional views and sections and various types of material.	
16. Use appropriate section linings, cross-hatching, conventions and symbols.	Point out to students that some objects have complicated interior shapes which cannot be easily shown and thus the need for special views and special techniques. Have the students apply appropriate section lining, cross-hatching and symbols to sectional views and sections.	Technical Drawings: General Principles, Canadian Standards Association

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DIMENSIONING DR101-08

Major Objective: To gain knowledge of and to acquire skills in dimensioning technical drawings.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the two components of dimensioning.	Demonstrate the need for and the use of a standard concise method of describing size and location of features on a drawing.	Two Components of Dimensioning 1. Size Description 2. Location Description Dimensioning and Tolerancing of Mechanical Engineering Drawings, Canadian Standards Association
2. Recognize the main terms associated with size and location description.	Demonstrate the application of dimensioning to a simple multiview drawing. Have the students assemble a "dictionary of dimensioning" in their notebooks, including dimensioning terms and their symbols.	Dimensioning Terms 1. Dimension Lines 2. Extension Lines 3. Leader Lines 4. Figures 5. Arrowheads 6. Finish Marks 7. Notes
3. Differentiate between overall and detailed dimensioning.	Have students apply both types of dimensioning to given multiview drawings.	Overall Dimensioning Indicates the overall length, width and height of an object. Detailed Dimensioning Provides information about the size or location of every detail and part of an object.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Identify the main dimensioning rules.	Have the students assemble a simplified list of dimensioning rules in their notebooks.	
5. Dimension objects containing plane surfaces, angles, radii and circles.	Have the students apply dimensioning to a number of drawings involving combinations of: plane surfaces, angles, radii, circles, unidirectional figures, aligned figures, tolerances, metric and imperial measurements, and multiview and pictorial representations. Integrate these exercises into the drafting program as much as possible.	
6. Differentiate between unidirectional and aligned figure placement systems.	Demonstrate both systems of figure placement.	Unidirectional Figure Placement System All dimension figures are placed between guide lines that are parallel to the bottom edge of the paper. Aligned Figure Placement System All dimension figures are placed between guide lines that are parallel to dimension lines.
7. Use correct methods of indicating tolerances.	Have students apply simple tolerancing to a mechanical drawing.	Tolerance The total amount by which a given dimension may vary.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
8. Identify the metric standards for dimensioning.	Have the students assemble a list of metric standards for dimensioning in their notebooks.	
9. Explain both soft and hard conversions from imperial to metric units.	Demonstrate both types of conversions.	Soft Conversions Determining equivalent sizes by multiplying by a constant or referring to conversion tables. Hard Conversions Determining equivalent sizes by selecting a preferred metric size to replace the imperial size.
10. Dimension isometric and oblique drawings.	Have the students apply and modify dimensioning rules to dimensioning a simple oblique and isometric pictorial drawing.	

PICTORIAL DRAWING DR101-09

Major Objective: To recognize the significance of and acquire related knowledge of pictorial drawing and techniques, and to develop related drafting skills.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Recognize the value of pictorial drawings in industry.	Discuss and show examples of how pictorial drawings provide a single view description of an object that is useful in explaining design features, assembly and overall shape. Indicate the present move in industry to the increasing use of the more easily interpreted pictorial rather than multiview drawings.	Pictorial Drawings A single view picture drawing.
2. Differentiate between projections and drawings.	Using isometrics, demonstrate the difference between: 1. Rotating an object for projection thereby foreshortening lines that are .8 of their actual length; and 2. Rotating an object for drawing, thereby drawing the lines in their actual length.	
3. Describe the features of the three types of pictorial drawings.	Illustrate the three types of pictorial drawings using drawings of a simple object such as a cube.	Three Types of Pictorial Drawings 1. Oblique 2. Axonometric 3. Perspective

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Identify the three types of oblique drawings.	Demonstrate the three types of oblique drawings using a simple object such as a cube.	Three Types of Oblique Drawings 1. Cavalier 2. Normal (General) 3. Cabinet
5. Choose an appropriate front view, receding angle and receding plane orientation for an object to be drawn in oblique.	Demonstrate the possible orientations and receding angles for oblique drawings of a simple object such as a cube.	Oblique Receding Plane Orientations 1. Receding Planes Toward Top Right 2. Receding Planes Toward Top Left 3. Receding Planes Toward Bottom Right 4. Receding Planes Toward Bottom Left Common Oblique Receding Angles 1. 30 Degrees 2. 45 Degrees 3. 60 Degrees
6. Draw oblique drawings of objects containing plane surfaces and curved surfaces.	Have the students construct and center several oblique drawings, using each of the three types of oblique drawing methods and a variety of plane and curved surfaces.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
7. Identify the three types of axonometric drawings.	Illustrate the three types of axonometric drawings with representations of a simple object such as a cube.	Three Types of Axonometric Drawings 1. Isometric 2. Dimetric 3. Trimetric
8. Draw isometric drawings of objects containing plane surfaces and curved surfaces.	Have the students draw and center several isometric drawings that include combinations of: plane surfaces, curved surfaces, circles, and sectioning.	
9. Use an isometric template.	Integrate the use of an isometric template for drawing circles and arcs in isometric planes with several projects in the course.	
10. Draw isometric half-sectioned drawings.	Have students convert an isometric drawing into an isometric half-sectioned drawing.	Isometric Half-Sectioning The cutting planes are parallel to both receding axes and intersect at the center.
11. Draw isometric full-sectioned drawings.	Have the students convert an isometric drawing into an isometric full-sectioned drawing.	Isometric Full-Sectioning The cutting plane is passed through the center of the object, and is parallel to one of the receding axes.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
12. Identify the three types of perspective drawings.	Using drawings of a simple object such as a cube, demonstrate the differences among the three types of perspective drawings.	Three Types of Perspective Drawings 1. Single Point (Parallel) Perspective 2. Two Point (Angular) Perspective 3. Three Point (Oblique) Perspective
13. Identify the common points and lines associated with perspective drawing.	With the use of drawings, illustrate each of the perspective drawing terms and its purpose.	Perspective Drawing Terms 1. Ground Line 2. Picture Plane 3. Vanishing Point(s) 4. Bird's Eye View 5. Normal View 6. Worm's Eye View 7. Station Point 8. Horizon Line
14. Draw one point perspective projections of objects containing plane surfaces.	Have the students produce a one point perspective projection of a simple object with plane surfaces, using a picture plane, horizon, ground line, vanishing point, station point and projection lines.	
15. Sketch two and/or three point perspective drawings of objects containing plane surfaces.	Have the students sketch several simple objects in both two point and three point perspective using a simple method for keeping the parts of the sketch proportional.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
16. Recognize several types of perspective drafting devices.	Demonstrate and have the students use each of the perspective devices wherever possible. If the devices are unavailable, illustrate their uses with slides, films or photographs.	Perspective Drafting Devices 1. Perspective Grid Sheets 2. Drafting Machine Attachments (Perspect-O-Metric) 3. Perspective Drawing Boards (KLOK) 4. Computerized Perspective Drafting Devices
17. Draw "exploded" illustrations using any of the three types of pictorial drawing methods.	Point out that "exploded" illustrations are used in industry as a means of communicating object assembly, parts identification and operation, and repair instructions. Have the students create an exploded illustration of a simple object using any of the three types of pictorial drawing.	Exploded Illustration A pictorial illustration in which each part of an assembly is drawn separately from the next but arranged in the order it should be assembled.

DEVELOPMENTS AND INTERSECTIONS DR101-10

Major Objective: To explore the purpose of and gain skills in drafting developments of objects, containers and patterns.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The students should be able to:		
1. Explain the uses of developments.	Discuss the areas of industry that use pattern development for the production of objects and containers using sheet material such as metal, paper, cardboard, plastic and fabric.	Developments The preparation of patterns or templates which, when properly formed, generate the surface desired.
2. Recognize the common symbols and lines associated with developments.	Explain and demonstrate the purpose of each of these terms by using a development of a simple container.	Terms Associated With Developments 1. Fold Lines 2. Bend Symbols 3. Stretchout Lines
3. Draw parallel line developments of objects containing plane and curved surfaces.	Have the students produce a parallel line development of a simple object and have them cut out their pattern, then fold and form the object.	Parallel Line Development A form of development used for objects having parallel elements.
4. Create a parallel line development of two simple intersecting shapes.	Have the students create a parallel line development of two simple intersecting shapes and have them cut out their pattern, then fold and form the object.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Construct radial line developments of whole and truncated cones and pyramids.	Have the students create radial line developments of a whole cone, whole pyramid, truncated cone and truncated pyramid. Have them cut out their patterns, then fold and form the objects.	Radial Line Development A form of development used for objects having fold lines coming from one point.
6. Draw a pattern for a simple object, using triangulation.	Have the students create a pattern of an offset circular or rectangular object requiring triangulation. Have them cut out their pattern, then fold and form the object.	Triangulation A form of development created by breaking a surface into a series of triangles.
7. Construct a development for a transition piece between two simple shapes, using triangulation.	Have the students produce a pattern for a transition piece between two simple shapes such as a square and a circle. Have them cut out their pattern, fold and form the transition piece, and then verify that it is the correct solution.	

CAREER EXPLORATION DR101-11

Major Objective: To gain information about the general occupational characteristics of a variety of drafting related careers and to match interests, abilities, preferences, and values to these characteristics.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify careers related to drafting.	Integrate and emphasize career instruction throughout the course by familiarizing the students with many careers, by providing a foundation on which to make career choices, and by encouraging self-evaluation in relation to various career opportunities and future goals.	Choices (Computerized Career Information Retrieval Program)
2. Collect information about careers related to drafting.	Discuss and have students outline the major occupational groups, the careers within each and the relationship of drafting to these careers.	
3. Identify skills required for jobs related to drafting.	Have the students develop a career file describing and listing skills required for careers related to drafting, using research, field trips and interviews to acquire information.	
4. Identify personal interests, abilities and needs.	Encourage students to analyze personal interests, abilities and needs, asking them to compare these to the description of occupational skills and characteristics previously researched.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Recognize the relevance of attitudes to working conditions and success.	Have the students identify attitudes that foster achievement on the job.	
6. Identify realistic educational and training plans for in drafting occupations.	Have the students assess qualification requirements for drafting careers to assist them in making realistic educational and training plans.	
7. Recognize the impact of technology on drafting careers.	Discuss the influence of technology on employment trends, life styles, speed of career change, and demands upon production.	
8. Explain the influence of social and economic trends on drafting careers.	Identify and discuss social and economic trends which can influence the alteration or elimination of certain careers.	
9. Identify ways in which jobs are advertised.	Have the students collect several advertisements for drafting related jobs, instructing them to prepare a personal application for the position of their choice.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
10. Understand the objectives of a job description.	Have the students examine and assess the advantages of job descriptions.	Objectives of Job Descriptions 1. Outline duties 2. Describe routines 3. Assign responsibility 4. Delegate authority 5. Designate accountability 6. Prevent conflicts 7. Describe general ability requirements 8. Categorize personnel 9. List expected skills and attitudes 10. State desired educational requirements.
11. Explain the need for a resumé, a portfolio, an application and an interview.	Explain the need for communication in all career situations. Have the students practice communication via resumés, applications and interview situations.	

drafting 201

DRAFTING 201

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STUDENT ORIENTATION AND SAFETY DR201-01

Major Objective: To gain information about the drafting course and about how to function successfully and safely in the program.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define drafting.	Have the students prepare a researched definition of the term drafting.	Drafting A universal graphic language of industry, used for communicating technical ideas.
2. Outline the method of evaluation to be used in this course.	Explain the system of evaluation to be used in the course, including the method of grading to be used on projects and the actual distribution of marks to be allotted for projects, quizzes, exams, attendance, notebooks, etc.	
3. Organize a notebook.	Have the students set up and maintain an orderly notebook that includes sections for notes, definitions, quizzes, projects, and other supplementary materials.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Identify the basic laboratory equipment and features.	Indicate the location of laboratory features and equipment and discuss their relevance to proper and safe student functioning in the laboratory. Have the students draw a floor plan of the laboratory incorporating the basic laboratory orientation information.	Laboratory Orientation Information 1. Fire Exits, Extinguishers and Alarm Switches 2. Major Pieces of Equipment 3. Tool Storage 4. Project Storage
5. Explain the need for safe practices in the laboratory.	Organize safety seminars and use daily laboratory practice and routine to demonstrate the proper procedures and techniques for safe handling of drafting equipment and tools.	
6. Differentiate between those behaviours which are considered safe and those which are not.	Have students describe alternative procedures for performing tasks in the laboratory, explaining the safety considerations for each alternative.	
7. Describe the need for safe clothing in the laboratory.	Have students participate in establishing an acceptable dress code for the program.	
8. Locate the safety aids in the laboratory.	Discuss the proper location and use of any safety aids found in the laboratory, or in close proximity to the laboratory. Have students demonstrate how they would handle incidents of injury, fire, and other emergencies.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Demonstrate the correct use of the safety aids found in the laboratory.		

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DRAFTING REVIEW DR201-02

Major Objective: To review those aspects of the Drafting 101 program which are important as an introduction to Drafting 201.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
	By referring to Drafting 101, review and highlight topics and skills preparing students to meet objectives set for Drafting 201.	

PRODUCT DESIGN DR201-03

Major Objective: To recognize the importance of design elements, principles and stages and to use these concepts in designing projects.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the elements of design.	List, define and discuss the elements of design, illustrating examples of each.	Elements of Design 1. Dot 2. Line 3. Shape 4. Value, (Tone) 5. Texture 6. Colour 7. Space Focus on Designing, McGraw Hill
2. Explain the purpose of the elements of design.	Explain how the elements of design are all interrelated in presenting a complete visual or structural idea.	
3. Use the elements of design.	Have the students use the elements of design to create two-dimensional design projects such as posters, charts and displays.	

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OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Identify the principles of design.	List, define and discuss each of the principles of design, referring to illustrated examples of each.	Principles of Design 1. Balance 2. Proportion 3. Rhythm 4. Harmony 5. Dominance 6. Movement
5. Explain the purpose of the principles of design.	Point out the relationship of the elements of design and the principles of design by indicating that principles guide a designer in using elements to prepare a unified design.	
6. Use the principles of design.	Have the students identify how the principles of design have been used in a selection of professional designs such as storefronts, signs and printed products.	
7. Identify the stages of the design process.	Discuss and explain the progressive development of a design of a simple object, focusing on each stage of the design process.	Stages of the Design Process 1. Problem 2. Restrictions 3. Requirements 4. Resources 5. Evaluation 6. Alternatives 7. Testing/Selection 8. Revision/Refining 9. Implementation

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
8. Explain the purpose of each of the stages of the design process.		
9. Use the stages of the design process.	Have the students design a simple object for which a list of specifications have been provided. Have them document and demonstrate how their designs evolved as they progressed through the various stages of the design process.	

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MECHANICAL DRAWINGS DR201-04 (Option)

Major Objective: To gain information related to the diversity of mechanical drawings and to develop skills and techniques for producing drawings representative of mechanical drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define working (or production) drawing.	Using sample drawings, explain the features and functions of working drawings.	Working (Production) Drawing A drawing that supplies information and instructions for the manufacture or construction of machines or structures.
2. Describe the two classifications of working drawings.		Classifications of Working Drawings 1. Detail Drawings provide the necessary information for the manufacturer of parts. 2. Assembly Drawings supply the necessary information for the assembly of parts.
3. Define tolerances.		Tolerances The permissible deviations in the specified form, size, or location of individual features of a part from that shown on a drawing.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Explain the purposes of tolerances on drawings.	Explain and give examples of the need for tolerances, illustrating ways in which these are expressed in drawings.	
5. List the ways of expressing tolerances on drawings.	Display several drawings with tolerances already applied, having students list the tolerancing methods used on the drawings.	Ways of Tolerancing 1. A Specified Tolerance for Each Dimension 2. A General Tolerance Note 3. A Specific Tolerance Note
6. Use accepted conventions of applying tolerances to drawings.	Have students apply various types of tolerances on several drawings produced in this course.	
7. Explain the reasons for surface texture control.	Explain that the specification of surface texture on a design is necessary for reducing friction and controlling wear on the finished product.	
8. Apply surface finishing specifications to a drawing using accepted conventions.	Have the students add surface texture symbols, specifying "roughness," "waviness" and "lay," to one of the machine drawings produced in this course.	Roughness Fine irregularities in the surface texture often including those which result from the inherent action of the production process.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
		Waviness Widely spaced components of surface texture resulting from such factors as machine or work deflections, vibration, chatter, heat treatment or warping strains. Lay The direction of the predominant surface pattern ordinarily determined by the production method used.
9. Define numeric control.	Demonstrate how the movement and consequent function of a machine in a two dimensional plane can be controlled through an X, Y coordinate system.	Numeric Control A means of directing some or all of the functions of a machine automatically from coded instructions.
10. Describe the two-dimensional system of numeric control.	Demonstrate to the students how the position in which a machine operation is to be performed on a flat object, can be described with the use of a two co-ordinate system.	
11. List the positive and negative characteristics of several types of materials used in manufacturing.	Explain how certain materials are more suited than others to meet the design requirements of various manufactured products.	Materials Used In Manufacturing 1. Ferrous Metals 2. Non-Ferrous Metals 3. Plastics

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
12. Describe several primary production processes used in manufacturing materials.	Demonstrate the way in which raw material is passed through a series of primary production processes to prepare it for secondary production. Have the students prepare a research paper on this process.	Primary Production Processes 1. Casting 2. Forging 3. Stamping 4. Machining 5. Welding
13. Explain several secondary production processes used in manufacturing materials.	Demonstrate the way in which material from a primary production process is passed through a series of secondary production processes to yield a finished product. Have the students prepare a research paper on this process.	Secondary Production Processes 1. Drilling 2. Reaming 3. Boring and Counterboring 4. Spotfacing 5. Countersinking 6. Knurling 7. Chamfering 8. Heat Treating 9. Milling 10. Grinding
14. List several types of threaded fasteners.	Display samples of a number of threaded fasteners, demonstrating their function.	Threaded Fasteners 1. Machine Screws 2. Cap Screws 3. Bolts 4. Studs
15. Differentiate between pictorial and conventional (simplified) representations of threads.	NOTE: The third type of representation, known as schematic representation, is no longer recommended by the Canadian Standard Association.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
16. Draw each of the two types of representations of threads, given the specifications for the fastener.	Have the students draw a simple threaded fastener in both conventional and pictorial representation, given the thread type, major diameter, root diameter and pitch.	
17. Draw the welding schematic symbols for several common welding joints.	Have the students prepare a "dictionary" of welding symbols in their notebooks.	
18. Use welding schematic symbols in simple mechanical drawings.	Have the students apply welding symbols to a simple assembly drawing requiring a variety of simple welds.	
19. Sketch several common types of gears.	With the use of examples, demonstrate several types of gears. Have the students identify and sketch these in their notebooks.	Types of Gears 1. Spur 2. Bevel 3. Worm
20. Identify the common terms used in describing simple spur gears.	Have the students apply spur gear terms to a drawing of a spur gear.	Spur Gear Terms 1. Outside Diameter 2. Root Diameter 3. Circular Thickness 4. Chordal Thickness 5. Whole Depth 6. Working Depth 7. Pitch Diameter 8. Base Diameter 9. Pressure Angle

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
21. Draw a simple spur gear, given its specifications.	Have the students produce a large scale drawing of a simple spur gear in either conventional or pictorial representation, given the outside diameter, root diameter, pitch diameter, circular thickness and pressure angle.	
22. Identify the common terms associated with cams.	Have the students apply cam terms to a diagram of a cam. Discuss with students the importance of the cam to automatic control and accurate timing, and cam commonality to many classes of machinery.	Cam Terms 1. Follower 2. Key 3. Shaft 4. Rise 5. High Position 6. Low Position 7. Base Circle
23. Draw a cam given the displacement diagrams of the follower.	Have the students produce a drawing of a cam by referring to the specific base diameter and the displacement diagram provided.	

BUILDING CONSTRUCTION DRAWINGS DR201-05 (Option)

Major Objective: To obtain knowledge related to building construction drawings and to develop skills and techniques for producing drawings representative of the building construction drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Differentiate between presentation drawings and construction drawings.	Demonstrate, with examples, the features and uses of presentation and construction drawings.	Presentation Drawings Simple and easily understood drawings used primarily for sales purposes. Construction Drawings Drawings which convey the exact information necessary to construct the building. Architectural Drawing and Design For Residential Construction, McGraw-Hill
2. Construct an interior one point perspective projection, given a simple floor plan.	Given a simple floor plan, have the students draw a one point perspective projection using a picture plane, horizon, ground line, vanishing point, station point, and projection lines.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
3. Identify the common basic house types.	Illustrate the common basic house types with the use of slides and pictures.	Basic House Types 1. Bungalow 2. Storey-and-a-Half 3. Two-Storey 4. Split-Level
4. Recognize the common roof types.	Describe the features of each of the common roof types with the use of illustrations and models.	Common Roof Types 1. Flat 2. Shed 3. Gable 4. Hip 5. Gambrel 6. Mansard 7. A-Frame
5. Draw the four elevations of a building.	Have the students prepare the four elevations of a simple building.	Elevation An orthographic drawing of the front, rear or side face of a building.
6. Construct a two point perspective projection of a building.	Have the students prepare a two point perspective projection of a simple building.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
7. Identify the symbols used to represent common floor plan components.	Have the students prepare a "dictionary of floor plan symbols" in their notebooks.	Floor Plan Components 1. Foundation Wall 2. Partition Wall 3. Single and Double Doors 4. Folding, Accordian and Pocket Doors 5. Flush, Slip and Lug Sill Windows 6. Bathroom Fixtures 7. Closets and Cabinets 8. Stairs 9. Appliances
8. Draw a plan view of a simple building.	Have the students draw the plan view of a simple building.	
9. Explain the basic terms used in house construction.		Basic House Construction Terms 1. Foundation and Footings 2. Damp Coarse 3. Weeping Tiles 4. Parging and Water Proofing 5. Backfill 6. Furring 7. Framing 8. Sill Plate Anchors 9. Joists and Studs 10. Bridging 11. Headers and Lintels 12. Sheathing and Vapour Barrier

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
		13. Lath and Drywall 14. Rafter and Ridgeboard 15. Roof Trusses 16. Flashing 17. Windows and Doors 18. Stairs
10. Draw a section of a house wall and foundation.	Have the students draw and label a simple section of an energy efficient house wall and foundation.	
11. Compile the window, door, cabinet and finish schedule sheets for a simple house design.	With the aid of examples, point out the use of schedules on drawings. Have the students design and compile schedules for a simple design.	

ELECTRICAL/ELECTRONIC DRAWINGS DR201-06 (Option)

Major Objective: To gain information related to electrical/electronic drawings and to develop skills and techniques for producing drawings representative of the electrical/electronic drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Differentiate between the four types of electrical diagrams as defined by the Canadian Standards Association.	Discuss and show examples of each of the four CSA recognized types of electrical diagrams. Stress that a connection diagram usually portrays the physical layout of the components while the interconnection diagram ignores this.	Types of Electrical Diagrams (CSA) 1. Single Line Diagram 2. Schematic or Elementary Diagram 3. Connection or Wiring Diagram 4. Interconnection Wiring Diagram Electrical and Electronics Diagrams, Canadian Standards Association Graphic Symbols for Electrical and Electronics Diagrams, Canadian Standards Association
2. Recognize the common symbols and connections associated with single line diagrams.		
3. Draw a single line diagram of a simple electrical/ electronic system.	Have the students draw a single line diagram based on a pictorial representation of a simple electrical system.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Identify the common symbols associated with electronic schematic diagrams.		
5. Draw a schematic diagram of an electronic circuit.	Have the students draw a schematic diagram given a pictorial representation of a simple electronic circuit.	
6. Explain the five types of connection/interconnection wiring diagrams.	Provide examples of each of the five types of connection/interconnection diagrams, stressing that each type can be illustrated either as a connection diagram (showing physical layout) or interconnection diagram (not necessarily portraying true physical layout).	Types of Connection/ Interconnection Diagrams 1. Continuous-Line 2. Point-To-Point 3. Highway 4. Interrupted-Line 5. Tabular
7. Draw a symbol connection diagram of an electrical system using one of the five types.	Have the students draw a symbol connection diagram, given a pictorial connection diagram of a simple electrical system. Invite students to use any of the five types of connection/interconnection wiring diagrams.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
8. Produce a pictorial connection diagram of an electrical system using one of the five types.	Have the students draw a pictorial connection diagram given a symbol connection diagram of a simple electrical system. Invite students to use any of the five types of connection/interconnection wiring diagrams.	
9. Draw the electrical connection plan of a simple house.	Have the students apply the electrical wiring symbols and connections to the floor plan of a simple structure.	
10. Draw an interconnection diagram of an electrical system using any one of the five types.	Provide the students a pictorial interconnection diagram of a simple electrical system and have them draw an interconnection diagram. Invite students to use any of the types of connection/interconnection wiring diagrams.	
11. Design a printed circuit layout for a simple electronic circuit.	Have the students design the pattern for a printed circuit, given the schematic diagram of a simple electronic circuit.	

PIPING/FLUIDIC DRAWINGS DR201-07 (Option)

Major Objective: To acquire knowledge related to piping/fluidic drawings and to develop skills and techniques for drafting drawings representative of the piping/fluidic drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the four types of piping drawings commonly used.	Discuss and show examples of each of the four types of piping drawings, indicating the uses of each of the types.	Types of Piping Drawings 1. Single-Line Orthographic 2. Double-Line Orthographic 3. Single-Line Isometric 4. Double-Line Isometric
2. Recognize several of the common graphic symbols used in single-line piping drawings.	Present students with graphic symbols used in single-line piping drawings and have them identify each symbol. Prepare and issue handouts showing these symbols.	Some Single-Line Piping Components 1. Pipes and Flanges 2. Elbows 3. Globe Valve, Gate Valve, Check Valve 4. Plug 5. Union 6. Cap 7. Tee 8. Flanged Joint
3. Draw orthographic or isometric single-line drawings of a simple piping system.	Have the students produce an orthographic or isometric single-line drawing, based on double-line pictorial drawing of a simple piping system.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Draw orthographic or isometric double-line drawings of a simple piping system.	Have the students produce an orthographic or isometric double-line drawing, based on a single-line drawing or a pictorial drawing of a simple piping system provided.	
5. Differentiate between the four types of fluid circuit diagrams.	Demonstrate, with examples, each of the four types of fluid circuit diagrams, pointing out the industrial applications of each.	Types of Fluid Circuit Diagrams 1. Pictorial 2. Cutaway 3. Graphical 4. Combination
6. Identify several of the common symbols used in graphical fluid circuit diagrams.		Fluid Graphic Components 1. Working Lines 2. Control Lines 3. Liquid Draw Lines 4. Pumps 5. Motors 6. Filter Strainers 7. Cylinders 8. Reservoir 9. Controls 10. Valves
7. Draw a graphical diagram of a simple fluid system.	Have the students prepare a graphical diagram, given a pictorial, cutaway or combination diagram of a simple fluid circuit.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
8. Produce a pictorial diagram of a simple fluid system.	Have the students prepare a pictorial diagram, given a cutaway, graphical or combination diagram of a simple fluid circuit.	
9. Draw a cutaway diagram of a simple fluid system.	Have the students prepare a cutaway diagram, given a pictorial, graphical or combination diagram of a simple fluid circuit.	
10. Prepare a combination diagram of a simple fluid system.	Have the students prepare a combination diagram, given a pictorial, cutaway or graphical diagram of a simple fluid circuit.	

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TECHNICAL ILLUSTRATION/SALES DRAWINGS DR201-08 (Option)

Major Objective: To explore technical illustration/sales drawings and to develop skills and techiques for producing drawings representative of the technical illustration/sales drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define technical illustration.	Show the students examples of technical illustrations, explaining how they are used to provide technical information.	Technical Illustration A pictorial drawing rendered to simplify and interpret technical information. Technical Illustration, John Wiley & Sons
2. List and give examples of several uses of technical illustrations.	Have the students collect samples of technical illustrations and maintain a list of their uses.	Uses of Technical Illustrations 1. Technical Manuals (Service, Operation, Process) 2. Illustrated Parts Lists 3. Graphic and Flow Charts 4. Catalogues 5. Technical Magazines

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
3. Identify the specialized equipment used by technical illustrators.	Demonstrate the proper use and care of as many of the pieces of technical illustration equipment as are available.	Technical Illustration Equipment 1. Drafting Set 2. Crow Quill Pen 3. Felt-Tip Pen 4. Technical Pens 5. Tapes 6. Art Knives 7. Art Brushes 8. Airbrush 9. Reducing Glass 10. Transfer Sheets and Films 11. Templates
4. Differentiate between outline shading and surface shading.	Demonstrate the difference between outline and surface shading by applying both types to a simple shape.	Outline Shading Adjusting the thickness and characteristics of only the perimeter lines of the surfaces of a drawn object. Surface Shading Applying shading to the surface areas of the drawn object.
5. Apply outline shading to a pictorial drawing.	Have the students apply outline shading to an illustration, using an accepted technique in either pencil or ink.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
6. Illustrate several types of surface shading.	Discuss and show examples of several types of surface shading, pointing out various uses of each type.	Types of Surface Shading 1. Freehand Line 2. Ruled Line 3. Stippled 4. Smudge 5. Pressure Sensitive Overlay
7. Apply surface shading to a pictorial drawing.	Have the students apply surface shading to an illustration, using an accepted technique in either pencil or ink.	
8. Draw an exploded orthographic drawing of an assembly.	Emphasize that the "exploded" technique in technical drawings is a means of conveying a great deal of technical information. Have the students produce a series of exploded illustrations of simple multi-component devices such as castors, rollers or c-claws. Instruct them to apply outline and surface shading in order to produce completed technical illustrations.	
9. Construct an exploded pictorial drawing of an assembly.		

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
10. List the materials required for air brushing.	Demonstrate the use and care of each of the pieces of equipment required for airbrushing, stressing the need for keeping the airbrush clean. Describe the operation of both types of air brushes. If either type is unavailable, use pictures to illustrate th- main principles.	Airbrush Materials 1. Drafting Equipment 2. Airbrush and Air Supply 3. Rubber Cement or Spray Glue 4. Razor Knife 5. White Illustration Board 6. Frisket Paper 7. Water Colour Brushes 8. Medicine Dropper 9. Designer's Watercolours or Airbrush Ink The Complete Airbrush Book, Leon Amiel Publishers Inc. The Advanced Airbrush Book, Van Nostrand Reinhold Company
11. Explain the operation of the two types of airbrushes.		Two Types of Airbrushes 1. Single Action 2. Double Action
12. Airbrush a pictorial illustration.	Have the students apply airbrush shading to a simple pictorial drawing containing plane surfaces and curves.	

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OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
13. List the materials required for producing wash renderings.		Wash Rendering Materials 1. Watercolours 2. Water 3. Soft Sable Brush
14. Identify the techniques for applying colour washes.	Demonstrate the use of watercolour rendering materials. Point out the applications of watercolour wash rendering in technical illustration.	
15. Apply watercolour wash rendering to a pictorial drawing.	Have the students apply colour wash to a pictorial drawing such as a perspective drawing of a house.	
16. Identify various media used to create renderings.		Other Rendering Media 1. Markers 2. Paints (Oil) 3. Scratch Board 4. Water Soluble Colour Pencils
17. Use several types of rendering media.	Demonstrate other types of rendering media, pointing out applications of each. Have the students do simple projects using as many media as possible.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
18. List several types of graphs and charts used in technical illustration.	Discuss and give examples of several types of graphs and charts, pointing out the applications of each.	Types of Graphs and Charts 1. Line 2. Column (Bar) 3. Surface 4. Pie 5. Pictorial 6. Flow 7. Alignment 8. Organizational 9. Engineering
19. Choose an appropriate type of graph or chart to illustrate a set of data.	Have the students choose and prepare a graph or chart to illustrate a set of data such as the height and weight of each student in the class.	
20. Draw a graph or chart to illustrate a set of data.		

GEOLOGICAL/TOPOGRAPHICAL DRAWINGS DR201-09 (Option)

Major Objective: To gain information related to geological/topographical drawings and to develop skills and techniques for drafting drawings representative of the geological/topographical drawings used in industry.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the typical scales used in map drawings.	With the aid of examples, describe several types of maps, their uses, and the typical scales in which they are drawn.	Scales Used in Drawings Preferred scale ratios are based on the 1,2,5 series in units of metres or kilometres. Mapping & Topographic Drafting, South Western Publishing (Gage)
2. Describe several types of maps used in industry.	Have students gather and display a variety of maps to be reviewed, classified, and discussed.	Types of Maps 1. Road 2. Topographical 3. Aeronautical 4. Cadastral (City or Town Layout) 5. Plat Survey (Survey Plan or Contour Plan) 6. Plot Plan (Building Site Plan)
3. Prepare a cadastral map of a simple subdivision.	Have the students prepare a cadastral drawing of a simple subdivision such as a lakeside cottage development.	Cadastral Map A map showing the layout of a city, town or district.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Draw a plot survey plan of a portion of a development.	Have the students produce a plot survey plan of a portion of a land development such as the subdivision previously designed.	Plat Survey Plan A map containing an accurate description of a tract of land.
5. Construct a building site plan.	Have the students draw the site plan of a lot from a land development such as the subdivision previously designed.	Building Site Plan A plot plan showing the orientation of a structure and its surrounding area.
6. Prepare a contour topographical map from a set of survey elevations.	Have the students draw a contour topographical map based on a specified set of grid survey elevations of a simple area of land.	Topographical Map An area map identifying land features by means of symbols.
7. Convert a simple topographical map into a block diagram (three dimensional isometric contour drawing).	Have students draw a block diagram of a topographical map.	
8. Draw a simple geological surface map.	Have the students apply geological information to a simple topographical map.	Geological Surface Map A topographical map that also contains information on geological formations, their strike directions and dip slopes.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Draw a geological section of a simple geological surface map.	Have the students draw a geological section of a portion of the above geological surface map.	Geological Section A supplement to a geological surface map delineating the presumed appearance of the area below the surface.
10. Produce a cartographic map.	Have students enlarge a portion of a city map, focusing on the areas between their homes and their school.	

drafting 301

DRAFTING 301

Module Title	Core-C Option-O	Page
01 Student Orientation and Safety	C	95 - 96
02 Review of Drafting 201	C	97
03 Computers and Drafting	C	98 - 100
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04 Product Manufacturing Drafting O		101 - 103
05 Architectural Drafting O		104 - 108
06 Engineering Drafting O		109 - 111
07 Other Drafting Applications O		112 - 114

STUDENT ORIENTATION AND SAFETY DR301-01

Major Objective: To gain information about the drafting course, and about how to function successfully and safely in the program.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define drafting.	Have the students prepare a researched definition of the term drafting.	Drafting A universal graphic language of industry, used for communicating technical ideas.
2. Outline the method of evaluation to be used in this course.	Explain the system of evaluation to be used in the course, including the method of grading to be used on projects and the actual distributing of marks to be allotted for assigned projects, quizzes, exams, attendance, notebooks, etc.	
3. Organize a notebook.	Have the students set up and maintain an orderly notebook that includes sections for notes, definitions, quizzes, projects, and other supplementary materials.	
4. Identify the basic laboratory equipment and features.	Indicate the location of laboratory features and equipment necessary for proper and safe student functioning. Have the students draw a floor plan of the laboratory incorporating the basic laboratory orientation information.	Laboratory Orientation Information 1. Fire Exits, Extinguishers and Alarm Switches 2. Major Pieces of Equipment 3. Tool Storage 4. Project Storage

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
5. Explain the need for safe practices in the laboratory.		
6. Differentiate between those behaviours which are considered safe and those which are not.	Have students describe alternative procedures for performing tasks in the laboratory, explaining the safety considerations for each alternative.	
7. Describe the need for safe clothing in the laboratory.	Have students participate in establishing an appropriate dress code for the program.	
8. Locate the safety aids in the laboratory.	Discuss the proper location and use of any safety aids found in the laboratory, or in close proximity to the laboratory. Have students demonstrate how they would handle incidents of injury, fire, and other emergencies.	
9. Demonstrate the correct use of the safety aids found in the laboratory.		

DRAFTING REVIEW DR301-02

Major Objective: To review those aspects of the Drafting 201 program which are important as an introduction to Drafting 301.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
	By referring to Drafting 201, review and highlight those topics and skills preparing students to meet objectives stiplulated for Drafting 301.	

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COMPUTERS AND DRAFTING DR301-03

Major Objective: To gain an understanding of and an appreciation for the functions of computers and computer-directed devices and their influence on drafting.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Define CAD.	Organize a tour of a facility that uses a CAD system. If possible, have students produce a drawing on a CAD system or a CAD simulator (i.e., a micro computer with associated software).	CAD A term representing one of the following: - Computer-Aided Drafting - Computer-Aided Design - Computer-Assisted Design - Computer-Augmented Design - Computer-Automated Design The CAD/CAM Workbook, South Western Publishing (Gage)
2. Explain the main categories of equipment associated with CAD.	Demonstrate how graphics information is manipulated in a CAD system, pointing out that the four basic operations required correspond with the four basic categories of equipment required.	Categories of CAD Equipment 1. Input 2. Processing 3. Storage 4. Output
3. Describe several types of CAD input devices.	Have the students research and list several pieces of equipment associated with computers, analyzing each to determine if it can be used to enter information into a computor. If available, have the students use several types of CAD input devices.	CAD Input Devices 1. Keyboard 2. Graphics Tablet 3. Light Pen 4. Joy Stick 5. Mouse

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. List the applications of several types of CAD input devices.	Have the students research or use the many types of CAD input devices and have them indicate the applications of each device.	
5. Describe several processing and storage devices used in CAD systems.	Have the students research and list several pieces of equipment associated with computers, analyzing each to determine if it is used to process or store information. Have the students use a CAD system, if available.	CAD Processing/Storage Devices 1. Central Processing Unit 2. Graphic Display Station (or CRT) 3. Disk Drive
6. List the function of each processing/storage device used in CAD systems.	Have the students research or use the CAD processing/storage devices and have them indicate the function of each device.	
7. Describe several output devices used in CAD systems.	Have the students research and list several pieces of equipment associated with computers, analyzing each to determine if it is used to ouput information.	CAD Output Devices 1. Plotters 2. Printers
8. List the advantages of each type of output device used in CAD systems.	Instruct students to research or use the CAD output devices, and have them indicate the applications of each device.	

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OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Describe the three basic command categories used in CAD systems.	Demonstrate the types of commands that are used in CAD systems. Pointing out how all of them fall into one of the three CAD command categories.	Three CAD Command Categories 1. Geometry Generators (used to enable a geometric shape to be created) 2. Size Generators (used to define sizes) 3. Geometry Modifiers (used to complete the shape description)
10. Describe the effects of CAD systems on drafting.	Discuss the effects that CAD systems are having on drafting. Emphasizing that while skill requirements are changing, drafters must still maintain familiarity with the principles of drafting.	CAD Systems Effects on Drafting 1. Alteration of Drafting Equipment 2. Revision of Drafting Skill Requirements 3. Elimination of Tedious Chores (i.e., Redrawing) 4. Reduction of Drafting Time

PRODUCT MANUFACTURING DRAFTING DR301-04 (Option)

Major Objective: To consolidate knowledge of design and technical drawing in the development and communication of ideas through the creation of product manufacturing drawings.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Explain each level of the graphic communication process.	Discuss the types of drawings used at each of the graphic communication levels. Follow the progression of an idea through the various levels of graphic communication to its final development in a set of construction drawings.	Levels of Graphic Communication 1. Creative Communication 2. Technical Communication 3. Market Communication 4. Construction Communication
2. Create several designs for a simple device with a prescribed set of specifications, using accepted design techniques at the creative communication level.	Supply students with a set of specifications, instructing them to use it in creating several ideas and designs of simple multi-part metal devices (i.e., a drafting tool holders, a handle for metal storage cabinet, a microphone stand, a cassette storage container,...). Ensure that students apply their knowledge of product design in completing their projects.	
3. Sketch a set of drawings to fully explain a design at the technical communication level.	Have the students develop the best of the aforementioned designs, refine them and produce a series of sketches of them.	Focus on Designing, McGraw Hill

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Explain each of the four basic types of model studies used in industry.		Types of Model Studies 1. Clay Studies 2. Scale Models 3. Mock-ups 4. Prototypes
5. Prepare an appropriate model study of a simple design.	Have the students choose and create an appropriate type of model study for the previously mentioned design.	
6. Create a presentation drawing of a simple design.	Have the students create a presentation drawing of the above design.	
7. Define detail working drawing.		Detail Working Drawing A drawing which provides enough information for the manufacture of parts.
8. Describe the types of detail working drawings.	Provide the students with several examples of detail working drawings. Have them list the types of detail working drawings that they have discovered.	Types of Detail Working Drawings 1. Pattern 2. Casting 3. Machining 4. Forging 5. Welding 6. Stamping

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Define <u>assembly working drawing</u>.		<u>Assembly Working Drawing</u> A drawing which supplies the necessary information for the assembly of parts.
10. Describe the types of assembly working drawings.	Provide the students with several examples of assembly working drawings. Have them list the categories of assembly working drawings that they have discovered.	<u>Assembly Working Drawings</u> 1. Multiview Assembly 2. Check Assembly 3. General Assembly 4. Subassembly 5. Exploded Pictorial Assembly 6. Instalation Assembly 7. Maintenance Assembly 8. Catalogue Assembly
11. Prepare a set of detail working drawings of a simple design.	Have the students prepare an appropriate set of detail working drawings of a simple multi-part metal device such as the object designed earlier in this module.	
12. Prepare a set of assembly working drawings of a simple design.	Have the students prepare a set of assembly working drawings of a simple multi-part device such as the object designed earlier in this module.	

ARCHITECTURAL DRAFTING DR301-05 (Option)

Major Objective: To incorporate awareness of design and technical drawing into the development and communication of ideas in the production of architectural drawings.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. List the requirements of a good architectural lettering style.	Provide and discuss examples of lettering that illustrate basic architectural lettering requirements. Have the students collect samples of professional architectural lettering.	Architectural Lettering Requirements 1. Legibility 2. Good Proportion and Taste 3. Artistic Effect 4. Reproducibility 5. Ease of Execution
2. Develop a style of architectural lettering.	Have the students develop their personal lettering style based on the above examples.	
3. Identify several common styles of architecture.	Have the students collect magazine and newspaper illustrations of traditional and contemporary styles of architecture and have them identify various architectural styles in their neighbourhoods.	Traditional Styles of Architecture 1. Tudor 2. Cape Cod 3. Georgian 4. Dutch Colonial 5. Victorian 6. Regency 7. French Provincial 8. Norman French

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
		Contemporary Styles of Architecture 1. Ranch House 2. A-Frame 3. Modern
4. List some factors affecting the placement of a house on a lot.	Discuss how each of the factors can greatly influence the final decision regarding the orientation of a house on a lot.	House Placement Factors 1. Shape of Ground 2. Environment 3. Climate 4. House Plan 5. Family Lifestyle 6. Building Code
5. Detail the factors affecting the use of interior space in a house design.	Illustrate, with the use of floor plans, how the living space (living, sleeping and working areas), circulation space and storage space are all provided for in a house design. Have students study house plans obtained from local builders, etc.	Interior Space Use Factors 1. Living Space 2. Circulation Space 3. Storage Space
6. Identify the factors to be considered in developing an energy efficient house design.	Discuss and give examples of ways in which each of the energy efficiency factors can be controlled and provided for in a house design.	Energy Efficiency Factors 1. Insulation 2. Airtightness 3. Humidity and Temperature Control 4. Fresh Air Control

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
7. Design a simple house, followng a set of specifications.	Have the students use preprinted grid sheets to design a simple structure (i.e., a cottage or modest house) which includes the principal elements of a dwelling. Have them modify and refine their designs until they meet a set of provided specifications.	Choosing a House Design, Canada Mortgage and Housing
8. Prepare a presentation drawing set for a simple house design sketch.	Have the students develop a presentation drawing set for the aforementioned structure design.	Elements of Presentation Drawing Set 1. Furniture Layout Plan 2. Elevations 3. Interior One-Point Perspectives 4. Exterior Two-Point Perspectives 5. Presentation Plot Plan
9. Construct an architectural model of a simple house design.	Have the students construct an architectural model to complement a structure design.	
10. Outline a typical sequence/organization of a set of architectural working drawings.	Distribute several sets of architectural working drawings, asking students to note the sequence/organization used in each set.	Typical Architectural Drawing Organization/Sequence 1. Site Plans 2. Foundation Plan 3. Floor Plan 4. Elevations 5. Building Section and Wall Sections 6. Details and Schedules

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
11. Prepare a site plan for a simple house design.	Have the students prepare a site plan for a house.	Site Plan A drawing by which the designer communicates the proposed site development ideas to the builder.
12. Draw a foundation plan for a simple house design.	Have the students prepare a foundation plan for a house such as the structure previously designed in this module.	Foundation Plan A drawing that includes information on the construction of the house up to and including the sub-floor of the first floor framing.
13. Draft a set of floor plans for a simple house design.	Have the students draft a set of floor plans for a simple house such as the structure previously designed.	Floor Plan A horizontal section through the building usually taken just below the tops of the windows and doors, used to show the location of the walls, partitions and all openings.
14. Prepare a set of elevations for a simple house design.	Have the students draft a set of elevations for a simple house such as the structure previously designed.	Elevation An orthographic projection of a view of a building, used to show the finished exterior features.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
15. Draw a building section for a simple house design.	Have the students draft a building section of a simple house such as the structure previously designed.	Section A drawing used to reveal the construction of internal features of a building.
16. Draft a set of interior details for a simple house design.	Have the students draft a set of interior details for the features of a simple house such as the structure previously designed.	Detail Drawing A drawing of a part of a building that cannot be clearly defined on the floor plans, section drawings or elevation drawings.
17. Compile a set of sched ules for a simple house design.	Have the students compile a set of schedules listing the major parts required for the construction of a simple house such as the structure previously designed.	Schedule A chart of materials and products required in construction, typically including door and window, room finish, and wall, floor, ceiling and roof assembly.

ENGINEERING DRAFTING DR301-06 (Option)

Major Objective: To apply knowledge of design and technical drawing to the creation and communication of engineering projects.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. List factors affecting a community plan.	Discuss and give examples of how each of the factors can influence a community plan.	Community Plan Factors 1. Characteristics of Residents 2. Accessibility 3. House Design Consistency 4. Natural Landscape Preservation 5. Parks, Playgrounds 6. Schools, Theatres, Churches 7. Shopping Facilities 8. Services Mapping & Topographic Drafting, South Western Publishing (Gage)
2. Outline the fundamental services to be incorporated into a community plan.	Discuss and illustrate the ways in which community services are incorporated into and affect a community plan.	Community Services 1. Maintenance Services 2. Protective Services 3. Public Services
3. Design a simple sub-division, following a set of specifications.	Have the students make a simple but good quality design of a small sub-division layout such as cottage development.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Survey a plot of land to determine a grid of elevations.	Demonstrate the use of a surveying level for determining the elevations of points on a grid that has been measured on a plot of land. Have the students survey a small plot of land, such as a school playing field, to determine the elevations of about forty points on a grid. Have them locate these elevations on a scale drawing of the plot of land and then produce a topographic map and model.	
5. Prepare a topographical model of a set of elevations.		
6. Detail the typical types of engineering drawings required for commercial projects.	Discuss and show examples of engineering drawings; if available, use the school construction drawings.	Types of Engineering Construction Drawings 1. Floor Plan 2. Structural Working Drawing Set 3. Mechanical Working Drawing Set 4. Electrical Working Drawing Set 5. Plumbing Working Drawing Set

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
7. Sketch several steel beam cross section shapes.	Provide the students with examples or pictures of several steel beam cross sections. Have them sketch the shapes in their notebooks.	Common Structural Steel Shapes 1. S Shapes (Standard Beams or I Beams) 2. C Shapes (Standard Channels) 3. W Shapes (Wide Flange) 4. M Shapes (Joists and Light Beams) 5. Structural Tees 6. L Shapes (Angles) 7. Hollow Structural Sections 8. Plates, Round & Rectangular Bars Engineering Drawing and Design, McGraw-Hill
8. Illustrate several steel structure systems.	Discuss and give examples of each of the steel structure systems. Have the students draw or build models of several steel structure systems.	Steel Structure Systems 1. Standard Bolted Structure System 2. Standard Welded Structure System 3. Unistrut System 4. Structural Domes 5. Geometric Plate Systems

OTHER DRAFTING APPLICATIONS DR301-07 (Option)

Major Objective: To gain design and technical drawing knowledge in the development of drawings and projects for sheet metal, aerospace, automotive, marine, and jig/fixture design.

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
The student should be able to:		
1. Identify the terms and symbols associated with sheet metal design.	Provide the students with several examples of sheet metal design drawings asking them to identify the terms and symbols characterizing sheet metal drawings.	Sheet Metal Terms 1. Development (Pattern, Stretchout) 2. Wire Hem 3. Single Hem 4. Double Hem 5. Lap Seam 6. Flat Lock Seam 7. Groove Seam Sheet Metal Practice and Pattern Development, McGraw Hill
2. Design the patterns for the components of a simple sheet metal assembly.	Provide students with a set of specifications for designing and producing the patterns for a simple multi-component sheet metal device such as a watering can, scoop, funnel or planter.	
3. Describe how drawings are used in the aerospace industry.	Discuss drawing use in the aerospace industry through the use of films or slides.	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
4. Contruct a simple orthographic aerospace drawing.	Have the students create their own ideas of a simple aerospace vehicle. Have the students produce simple aerospace drawings (i.e., of the chord of a wing or a fuselage section).	
5. Identify how drawings are used in the automotive industry.	Discuss and describe the application of drawings in automotive industry, using films or slides as a resource.	
6. Produce a simple drawing typical of those produced in the automotive industry.	Have the students create the body design of their concept of an ideal automotive vehicle or machine. Have the students produce simple drawings of automobile parts, such as a rack and pinion steering system or a bearing assembly.	
7. Describe how drawings are used in the marine industry.	Discuss and describe the application of drawing in the marine industry, using films or slides as a resource.	
8. Create a simple marine drawing.	Have the students produce simple marine related drawings (i.e., marine drafting assembly drawings).	

OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	SUGGESTED MATERIALS
9. Differentiate between jigs and fixtures.		Jig A movable device used for guiding a cutting tool in a series of identical operations. Fixture A fixed device used for holding an item while operations are performed on it.
10. Design a simple assembly (or machining) jig or fixture to do a specified task.	Have the students design a simple jig or fixture to do a specified task like drilling holes in a certain machined part using locking pins and guide pins for accuracy.	

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Technical Drafting - Metric Design and Communication. (Spence/Atkins) Peoria, IL: Bennett, 1980. (BP)

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Technical Illustration. (Bethune) New York, NY: John Wiley & Sons, 1983. (JW) (Supplement to "Technical Illustration/Sales Drawings" unit of curriculum depending upon option chosen)

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MODULES	FUNDAMENTALS OF TECHNICAL DRAWING	DRAFTING FUNDAMENTALS
- Student Orientation & Safety		
- Junior High Drafting Review		
- Drafting Equipment & Practice	Chapter 2	Chapter 2
- Geometric Application	Chapter 8	Chapter 16
- Sketching		Chapter 2, 14
- Drawing Interpretation	Chapter 17, 20, 11, 9, 21, 23	Chapter 3, 15
- Multiview Drawing	Chapter 4, 6, 13, 20	Chapter 3, 8, 7
- Dimensioning	Chapter 9, 10	Chapter 4, 12
- Pictorial Drawing	Chapter 22, 17	Chapter 9, 5
- Developments & Intersections	Chapter 21	Chapter 10
- Career Exploration	Chapter 1	Chapter 1

DRAFTING 201

MODULES	TECHNICAL DRAFTING: METRIC DESIGN & COMMUNICATION	ARCHITECTURAL DRAWING & DESIGN FOR RESIDENTIAL CONSTRUCTION	METRIC DRAFTING PROBLEMS	TECHNICAL ILLUSTRATION	MAPPING & TOPOGRAPHIC DRAFTING
- Student Orientation & Safety					
- Review of Drafting 101					
- Product Design					
- Mechanical Drawings	Chapter 11,13,14, 22	---	Chapter 27a, 27c,24a,24b, 25a,25c,26a, 26b,14a,14b, 30a,30c,15a, 15b,16a,16b	Chapter 6, 7,9	---
- Building Construction Drawings	Chapter 18	Chapter 7,2, 10,19	Chapter 22a, 22c	Chapter 18, 19	---
- Electrical/Electronic Drawings	Chapter 21	Chapter 5	Chapter 28a, 28b	---	---
- Piping/Fluidic Drawings	---	---	Chapter 29a, 29e	---	---
- Technical Illustration/ Sales Drawings	Chapter 15	Chapter 7	Chapter 23a, 23f	Chapter 10, 16	---
- Geological/Topographical Drawings	---	Chapter 4,10	---	---	Chapter 1-12

DRAFTING 301

MODULES	TECHNICAL DRAFTING METRIC DESIGN & COMMUNICATION	ARCHITECTURAL DRAWING & DESIGN FOR RESIDENTIAL CONSTRUCTION	METRIC DRAFTING PROBLEMS	TECHNICAL ILLUSTRATION	MAPPING & TOPOGRAPHIC DRAFTING
- Student Orientation & Safety					
- Review of Drafting 201					
- Computers and Drafting	Chapter 16	---	Chapter 33a, 33b	Chapter 16	---
- Product Manufacturing Drafting	Chapter 15	---	---	Chapter 10	---
- Architectural Drafting	---	Chapter 1-12	Chapter 33a, 33f	---	---
- Engineering Drafting	---	Chapter 2	---	---	Chapter 8, 10
- Other Drafting Applications	Chapter 19	---	Chapter 21a, 21f	---	---

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MAGAZINES, JOURNALS, PERIODICALS

Architectural Record
available from: McGraw-Hill Ryerson Ltd.
330 Progress Avenue
Scarborough, ON M1P 2Z5

Design Graphics World
available from: Design Graphics World
6255 Barfield Road
Atlanta, GA 30328 USA

Industrial Education
available from: Cummins Publishing Company
1495 Maple Way
Troy, MI 48084 USA

The Technology Teacher
available from: International Technology Education Association
1914 Association Drive
Reston, VA 22091 USA

Progressive Architecture
available from: Reinhold Publishing
P.O. Box 95759
Cleveland, OH 44101 USA

School Shop
available from: Prakken Publications Inc.
416 Longshore Drive
P.O. Box 8623
Ann Arbor, MI 48107 USA

The Canadian Architect
available from: Southam Business Publications Ltd.
1450 Don Mills Road
Don Mills, ON M3B 2X7

16mm Film

The following films are available from Manitoba Education Library. (MEL)

0663	A is for Architecture
3152	Choosing a House Design
2822	Discovering Perspective
1390	Drafting Tips
0522	Drawing and Planning
3801	Houses
2254	Modulo: Variations on a Design
1291	Perspective Drawing
2365	The Choice is Yours
4078	The Foundation
3151	The House of Tomorrow
4079	The Wood Shell
0424	What's in a House?

35mm Film and Cassettes

The following filmstrips and cassettes are available from School Services of Canada. (SSC)

Construction of a Staircase

Elements of Brickwork

Painting a Panelled Door

Perspective: Understanding Space, Part One

Perspective: Understanding Space, Part Two

Roof Construction - The Common Rafter

Walls and Bonds

AIA American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006 USA

ATP American Technical Publishers
Alsip, IL 60658 USA

ATS American Technical Society
Chicago, IL 60637 USA

BP Bennett Publishing Company
866 Third Avenue
New York, NY 10022 USA

CCP Copp Clark Pitman
495 Wellington Street, West
Toronto, ON M5V 1E9

CMHC Canada Mortgage & Housing Corporation
870 Portage Avenue
Winnipeg, MB R3G 0P3

CSA Canadian Standards Association
178 Rexdale Boulevard
Rexdale, ON M9W 1R3

GP Gage Publishing Ltd.
164 Commander Boulevard
Agincourt, ON M1S 3C7

GPC Glencoe Publishing Co.
17337 Ventura Boulevard
Encino, CA 91316 USA

JW John Wiley & Sons, Inc.
605 Third Avenue
New York, NY 10158 USA

LAP Leon Amiel Publisher Inc.
31 West 46th Street
New York, NY 10036 USA

ME Manitoba Education
Industrial Arts
411-1181 Portage Avenue
Winnipeg, MB R3G 0T3

MEL Manitoba Education Library
Main Floor, 1181 Portage Avenue
Winnipeg, MB R3G 0T3

MEM Manitoba Energy & Mines
301 - 450 Broadway Avenue
Winnipeg, MB R3C 0V8

MH Manitoba Hydro
P.O. Box 815
Winnipeg, MB R3C 2P4

MHR McGraw-Hill Ryerson Limited
330 Progress Avenue
Toronto, ON M1P 2Z5

MPC Macmillan Publishing Company Inc.
866 Third Avenue
New York, NY 10022 USA

NRC National Research Council of Canada
15 Innovation Boulevard
Saskatoon, SK S7N 2X8

National Research Council of Canada
Building M58
Montreal Road
Ottawa, ON K1A OR6

PH Prentice Hall Canada Inc.
1870 Birchmount Road
Scarborough, ON M1P 2J7

SSC School Services of Canada
66 Portland Street
Toronto, ON M5V 2M8

SWP South Western Publishing Co.
510 Madison Road
Cincinnati, OH 45227 USA

VNR Van Nostrand Reinhold Co., Inc.
115 Fifth Avenue
New York, NY 1003 USA